# Can Economic Openness Improve the Health Status of Bangladesh Economy: An Empirical Analysis

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*Economic openness especially in developing countries like Bangladesh greatly contributes to an increase in the country's welfare through the increase in standards of living, education, as well as health status. Through globalization, the positive effects of health is prominent as access to health technologies are readily made available which can go a long way to increase life expectancy as well as reduce infant mortality rates. This research paper empirically examines the cointegration and causal relationship between economic openness and health status of Bangladesh economy by using annual data from 1980 to 2014. As the economy becomes more open, investments in health sector also increases which facilitate improvements in health. To further explore this relationship, Augmented Dickey Fuller (ADF) test has been used to check if the variables are stationary. The Johansen cointegration method has also been used in order to check the robustness of the relationship among the variables. Vector Error Correction Model (VECM) has been estimated in order to determine the short-run dynamics of this behavior followed by the Granger causality test. The results reveal that long-run bidirectional causality runs from economic openness to health and vice versa, which provides support that rise in economic openness is both a cause and a consequence of increased health status of Bangladesh.*

**Field of Research:** Economics

## 1. Introduction

The economies around the world have experienced an increase in openness to international trade during the last three decades. The growing interconnectedness among the economic, political, as well as cultural processes between countries as a result of globalization has helped to increase a country's economic growth and development. In developing countries, increase in economic openness greatly contributes to an increase in a country's welfare through improvements in standards of living, productivity and employment, health systems, education, as well as social and natural environmental factors.

Developing countries in the past has faced constraints to economic growth due to barriers placed on trade. However, through mutually beneficial trade agreements, the trade barriers were eliminated in order to promote intra-regional trade in goods by removing tariffs and eliminating non-tariff barriers to trade as a result of trade liberalization. The World Bank and International Management also helped to reform

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markets through changes in loans in order to help the developing countries to increase their investment and gain access to new markets internationally. This economic openness thus helps developing countries to enhance their competition by reducing their cost of inputs. It also serves as a driving force for countries to move up the Global Value Chains (GVCs).

When countries experience more economic openness, there is an indirect positive effect on the health of its nations. When global economic integration raises the welfare of its nation through increase in individuals' income and better living standards, it can lead to better health and nutrition especially in developing countries. As government revenues increase, investments in health sector also increases which facilitate improvements in health. Income is an important determinant to health because it determines how individuals can get better access to necessities such as food, medical care etc. Food insecurities can lead to dietary deficiencies where households face the likelihood of chronic diseases due to not being able to afford or consume nutritious food. When households do not get adequate nutrition and are deprived of healthcare, it can lead to infant mortality and malnourishment as well. Malnutrition in children can hamper the development of children which can have a prolonged effect during the later years in their lives. Increase in income due to trade openness can give access to food security which is important for proper nutritional intake in order to maintain a healthy life. As countries experience more economic openness, increase in income can lead to a decrease in child mortality, rise in maternal health as well as greater level of education for women. As a result, rising income due to trade openness has a greater contribution to health through income.

When China abolished its trade restrictions and encouraged free trade in 1978, the government's goal was to engage in foreign trade and development. Since then, the country has managed to transform itself into being the world's greatest opponent of globalization. Moreover, through proper health reforms, the quality of life and many aspects of public health has seen significant progress. The life expectancy of China has managed to increase significantly over the last 20 years and childhood mortality rates has fallen by more than half (World Development Indicators 2017). This dramatic improvement in the standard of living and health as a result of economic and social reforms has made the country experience tremendous success in the era of globalization.

The improvements in health has also been significant in Mexico which experienced an increase in its life expectancy at birth from 57 years in 1960 to 77 years in 2015. The country experienced an openness to international trade where trade as a percentage of GDP vastly increased from 20% in 1960 to 78% in 2015 (World Development Indicators 2017). The loosening of its trade barriers and lower restrictions on investments has made it possible especially in Northern Mexico to achieve benefits of international trade. Due to this rise in economic openness, Mexico has experienced solid achievements towards the improvements in its health sector through proper health reforms including family planning programmes.

Globalization impose positive effects on health especially in developing countries through its integration into the world economy. As access to newer technologies as well as availability of doctors become readily available at a lower cost, trade openness can benefit the health sector through the increase in trade for medical

supplies such as vaccines and drugs in developing countries. Moreover, increase in the flow of knowledge can also contribute to administer public health programs in the developing countries.

Bangladesh has experienced an economic transformation with achievements in health, education and gender equality. The GDP in Bangladesh was 18.138 billion USD in 1980 and 195.078 billion USD in 2015, which shows a steady growth rate in its GDP (World Development Indicators 2017). The country's emergence as an open economy has helped to promote specialization and accelerate investment through access to bigger markets. Bangladesh, even though it is currently a lower-middle income country, aims to achieve for Middle Income status by 2021 as it has made prominent progress in its advancement of growth and development.

Since its independence, Bangladesh has made significant progress in its health as well as development. The fertility rates has vastly experienced a downward trend from 6 births per woman during 1980 to 2 births per woman in 2010. Moreover, the country has been seen to experience a downward trend in its infant mortality rates as well as total mortality rates during the last few decades (World Development Indicators 2017).

The government since its liberation has ensured health development policies by providing basic services to its over 160 million population, especially in rural areas. However, due to its large population, adequate funding and resources for the provision of basic healthcare remains constrained. Nevertheless, the Primary Health Care (PHC) plans have been the primary approach for improving the health status of the country and has focused on many development programmes in order to ensure that proper healthcare services be made available in all parts of the country. However, even though the country suffers from poverty and most Bangladeshis earn through subsistence farming in rural villages, the country has still managed to progress on the Human Development Index. The Health, Population, and Nutrition Sector Development Programme (HPNSDP) has contributed towards the improvement of a number of health indicators, such as reduction in under-five mortality, immunization coverage, maternal mortality and total fertility. Bangladesh has also experienced improvements in women's education, life expectancy as well as economic conditions. Moreover, non-governmental organizations (NGOs) have emerged as a "third sector" in order to provide a number of healthcare facilities such as healthcare and family planning services in order to complement the government's small capacity of providing healthcare services.

The relationship between globalization and health has been studied a few number of times in order to examine the impact of globalization on health. Owen and Wu (2007) focused on the effect of globalization on health and found that as countries become more open to trade, the level of infant mortality significantly falls while life expectancy rises due to globalization. However, according to their analysis, the benefits seem to be much more enjoyed in lower developed countries than in highly developed countries. This outcome is also evident in another research conducted by Steven, Urbach and Wills (2013), where they examined the relationship between free trade and health, and concluded that improvements in life expectancy is evident with a rise in globalization. In another research conducted by Dollar (2001), the paper examines whether globalization is good for health. The results point out that although trade openness can enhance the positive outcomes of improvements in health and

welfare, proper policies in developing countries need to be established in order to reap the benefits of trade openness and liberalization.

To the best of our knowledge there are no empirical studies which explicitly address the causal relationship between economic openness and health from the context of Bangladesh. Hence, the main objective is to answer the two following questions:

1. Is there any long run relationship between Economic Openness and Health?
2. If cointegration exists, what is the direction of causality between the two variables?

The rest of the paper is organized as follows: Section 2 describes the theoretical background and empirical literatures. Section 3 discusses the overview of health status in Bangladesh, while section 4 comprises of the methodology and data set of this paper. Empirical findings and results are interpreted in section 5 followed by conclusion along with limitations and recommendations in section 6.

## 2. Literature Review

### 2.1 Theoretical Background

Globalization helps countries to develop through the integration of trade and increase in economic growth. This integration has been particularly evident in the case of East Asia since the 1980s where FDI inflows strengthened the intra-regional trade; and was a contributing factor to economic growth. Furthermore, due to globalization, trade barriers are reduced or eliminated, and so countries are able to specialize on exporting goods in which it has a comparative advantage. As a result, this opens up the possibility of a higher rate of economic growth.

As markets open up further and become more liberalized, the levels of employment and per capita income is affected in more positive ways thus leading to an increase in consumption and standards of living. As countries become more open towards free trade, imports become cheaper, and level of exports rise thus leading to a fall in the relative price of goods. Countries which have specialized in accordance with their comparative advantage since the postwar period has been seen to grow at a higher rate such as Japan and other Southeast Asian countries (Gallardo 2005). Moreover, as trade and economic growth increases, access to newer technologies through imports become more reasonable due to lower trade barriers which helps to increase a firm's productivity thus giving rise to employment. Furthermore, governments also benefit from increase in revenues through taxation and exports which can be invested in sectors such as health and education.

Health sector can also be positively affected through the rise in globalization with the help of easier access to newer technology as well as medical supplies and healthcare (Bergh & Nilsson 2010). In addition, as income rises, it also leads to positive effects on health. Globalization also leads to a rise in knowledge spillover which can be very helpful in terms of better healthcare systems as well as technologies facilitated towards the treatment of communicable and non-communicable diseases. According to Stevens, Urbach, and Wills (2013), "Knowledge spillovers are an intrinsic outcome of increased international trade. When the costs of trade are lowered, it becomes easier to disseminate to other

countries knowledge, techniques and medical products from the countries that developed them. This knowledge can have a profound impact on health outcomes" (p. 132).

**Figure 1: Flowchart of the Impact of Globalization**
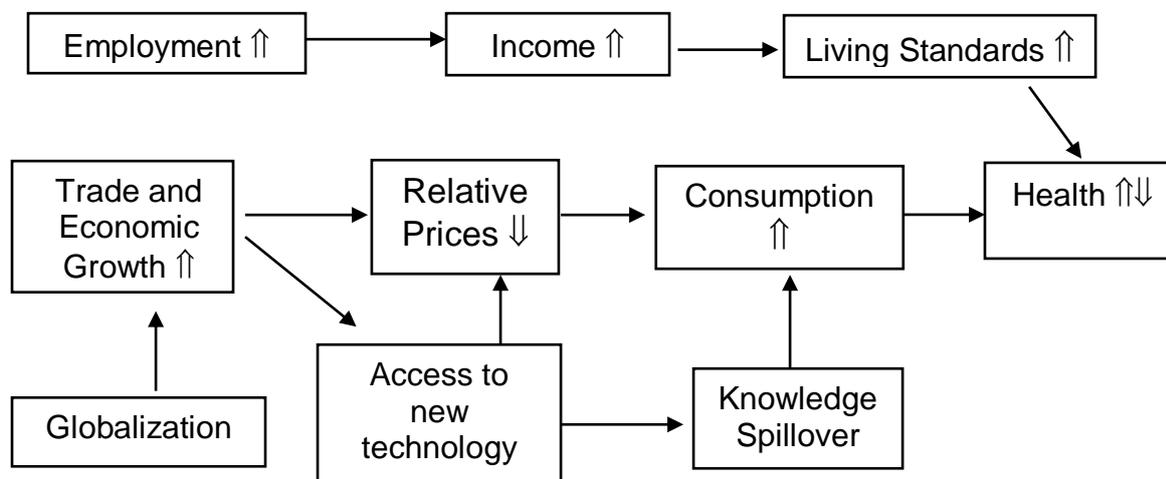


*Source: Author's compilation from Ringkvist (2016)*

As seen on the figure above, globalization can have positive effects through the rise in economic growth and subsequent increase in income and living standards through employment. This rise in economic growth leads to the access of newer technologies which can affect health positively. However, globalization can also affect health in negative ways. When income rises as a result of economic growth, consumption of unhealthy foods also increases. As people's income increases, there exists a tendency to consume products which can worsen health such as tobacco, alcohol consumption and high processed foods such as sugar and unhealthy fats; thus giving rise to health related problems. Consumption of these unhealthy foods can lead to obesity and other heart related problems which can create negative health impacts (Bergh & Nilsson 2010). As a result, when countries experience economic growth due to trade openness, greater policies and institutional measures can help in order to avert the negative impacts of rising income on health status such as increasing taxes on tobacco and restriction on smoking in public areas.

## 2.2 Empirical Literature

The relationship between globalization and economic openness has been well researched, however very few research has been conducted regarding the effects of globalization and health in a country specific manner. The existing empirical literature focusing on the concept of globalization and health are presented below.

Herzer (2017) exploredthe long-run relationship between trade and population health. A panel of 74 countries from the period 1960 till 2010 has been used in this analysis. The empirical results focus on the existence of Granger causality test, Augmented-Dickey-Fuller (ADF) test, cointegration, and panel unit root test as well as Error Correction Model (ECM). The results showed that long-run causality exists in both directions as trade increase is both a cause and a consequence of increased life expectancy.

Novignon and Atakorah (2016) explores how health sector benefits from trade openness. The authors used a panel data of 42 Sub Saharan African Countries from 1995 till 2013, in order to analyze the effects of trade and health outcome. By using the fixed effect model, random effect model and the Generalized Method of Moments (GMM) models, the results found that a positive relationship exists between trade openness and life expectancy. However negative relationship prevails between trade openness and infant mortality rate as well as under-five mortality rate.

Panda (2014) focused on the effect of trade on infant mortality in Sub-Saharan Africa before and after the countries joined the trade agreement African Growth and Opportunity Act (AGOA) between US and Sub-Saharan Africa. The authors used a linear probability model with country-fixed effects and mother-fixed effects in order to find out the effect of trade policy on infant mortality rates. The findings showed that AGOA leads to a reduction of around 7 infant deaths per 1000 births.

Steven, Urbach and Wills (2013) examined the relationship between free trade and health. The authors used a panel data for a range of countries from 1950 till 2009. Health measures such as infant mortality rate and life expectancy of male and female were used in this research. The authors also used real GDP per capita as trade measures and by using the fixed effect regression model, they found that trade openness leads to improvements in life expectancy as well as infant mortality rates. However, these outcomes are much more consistent with lower income countries.

Anukriti and Kumler (2012) analyzed the effect of trade liberalization on fertility and child health in India from the period 1987 till 1997. The paper focuses on the impact of India's 1991 trade reforms for free trade and its subsequent effects on health indicators such as fertility rate, infant mortality rate, and observed sex ratios at birth. By using OLS and IV regression with fixed effects approach, the results showed that as India became more open to trade, less educated and less wealthy women who had higher relative trade exposure were more likely to give birth. On the contrary, as more educated and wealthier mothers had improved earning opportunities, they experienced higher infant mortality.

Mukherjee and Krieckhaus (2011) focused on the effect of globalization and human well-being. Panel data of 132 countries from 1970 till 2007 has been used to evaluate their analysis. The results are obtained by using the KOF index of globalization and three health measures (infant mortality, child mortality, and life expectancy) with fixed effect estimations. Their analysis showed that, globalization has an overall positive effect on health, however the result is stronger in case of child mortality than life expectancy.

Bergh and Nilsson (2010) finds a positive relationship between globalization and health in their literature. They used a panel data of 92 countries with different levels of income through the period 1970 till 2005. KOF index of globalization is also used here with various measures of health indicators. They apply the fixed effect regression and panel-corrected standard errors (PCSE) for their results and note that, across developing countries, globalization seems to have a positive health impact especially in countries with stable democracies.

Tsai (2007) examined the effect of globalization on health and human well-being by using a panel of 112 low-middle and high income countries through the period 1980 till 2000. This research uses KOF index of globalization in order to find out how globalization affects health as well as quality of life which is measured by the Human Development index (HDI). By using GLS random effect model with health variables such as life expectancy, infant mortality rate as well as literacy rate – the analysis finds that a significant positive effect exists between globalization and health, however mostly in industrialized nations.

Owen and Wu (2007) explored the relationship between trade openness and health outcomes by using a panel data of 139 countries from the period 1960 till 1995. The paper analyses the relationship through the use of fixed effects models with health indicators such as child mortality, female life expectancy, and male life expectancy along with policy based measures of openness such as GDP and black market premium. The analysis reveals that countries with low income are more likely to be benefitted from globalization through increase in health than countries with higher incomes.

Levine and Rothman (2006) focused on whether trade affects child mortality. The authors used a panel data of 100 to 130 countries and use two measures of child health (infant mortality rate and child mortality rate) and found that, trade is correlated with a fall in infant mortality and child mortality rate. These results are primarily affected due to the increase in GDP from increased trade. By using two-stage least square regressions (2SLS) for actual trade and child health outcome due to trade, the authors concluded that an increase in GDP due to trade had a significant effect on the reduction of infant mortality.

We have provided a summary based on the studies focusing on economic openness and health which has been discussed in the Appendix.

## 3. Overview of Bangladesh

Bangladesh has been upgraded from low income country (LIC) to lower-middle income country (LMIC) with GNI per capita of 3,550 PPP dollars as of 2015 (World Development Indicators 2017). During its independence, Bangladesh had very little opportunities due to being a resource-constrained economy along with a large population. Regardless, the country has made remarkable progress from being a socialist economy towards a liberalized economy with achievements in economic development. Bangladesh has maintained the average annual growth rate of 6.6% in 2015 with increases in GDP from 18.138 billion current USD in 1980 to 172.885 billion current USD in 2014. (World Development Indicators 2017).

The economy of Bangladesh adopted policies during its liberalization towards economic openness through privatization as well as deregulation with lower restrictions on trade. Through imports, exports, remittances, FDI and official development assistance (ODA), the country has managed to increase its efficiency and integrate with the global economy by more than 60% since the 1970s.In Bangladesh, the increase in efficiency has been the result of moving along its production possibility frontier through the increase in labor-intensive export of goods. This is evident as over the last decade, Bangladesh experienced an increase in the amount of exports by more than 80%.

The average person in Bangladesh now live longer and life expectancy at birth has increased from 53 years in 1980 to 70 years in 2010. The average life expectancy of Bangladesh is 71.6 years in 2014 which has increased from 70.5 years in 2013. This figure is higher than India and Pakistan where India's life expectancy has been 68.01 years in 2014 and 66.18 years for Pakistan in 2014. However, the average life expectancy of men is less than women in Bangladesh. (World Development Indicators 2017).

Bangladesh has met the target of reducing its under-five mortality rate by more than 60%. In 2000, the rate was 88 per 1,000 live births and came down to 44 per 1,000 live births in 2011, and achieved 39.5 per 1,000 live births in 2014 (World Development Indicators 2017). The country has also been successful in keeping its infant mortality rate on track. Bangladesh has implemented a wide variety of programs to battle its infant mortality rate problem through disease control in children as well as vitamin supplementations which has further promoted the decline in infant deaths. As a result, Bangladesh has successfully met its Millennium Development Goal 4 by reducing under-five mortality rate by two-thirds between 1990 and 2015.

Fertility rate has been the most important determinant in measuring a country's population. Bangladesh has undergone a significant decline in its total fertility rate from 6.4 births per women in 1980s, to 2.2 births per women in 2014 (World Development Indicators 2017). This shows that the country has managed to achieve prominent success in reducing its fertility rates during the last three decades. Socioeconomic determinants such as employment status has been seen to impact the rate of fertility of women in Bangladesh. Khuda and Hossain (1996) examined that females tend to use contraceptive methods when they are in the workforce. The women who are employed seems to perceive more favorable fertility norms as well as attitudes and it also helps them to feel empowered in their house-hold decision making while at the same time, increasing the opportunity cost of childbearing. In addition to employment status, education also plays a large role affecting the fertility rates in Bangladesh. Female education plays a big role as it tends to increase the age of females getting married, which reduces the number of years devoted to child bearing. As more women become educated, the desire for larger families becomes smaller.

Bangladesh stands at being the 8th most populous country in the world, and since its independence, the country has focused on a number of policies to reduce its fertility rates in order to control its high population growth. Even though the country has managed to reduce its maternal and child mortality rate while, at the same time, made significant improvements in child nutrition status, children in poverty stricken areas seem to bear the burden of stunted growth. Bangladesh health sector also faces the challenge of communicable and non-communicable diseases and so the country is undergoing a health transition in order to combat these challenges. Moreover, the Family Planning Programme in Bangladesh has succeeded to keep its fertility levels in check during the last three decades. Regardless, even though the total fertility rate is now at a downward trend, the country is expected to undergo a soar in population due its effects of population momentum in spite of experiencing a lower level of fertility as well as lower death rates.

## 4. Methodology

In order to check the stationary of the variables, the unit root test has been implemented in this paper. For levels to be non-stationary in the system, the theory of cointegration needs time series, as the financial and macro variables tend to be non-stationary. We need to know that the integration is in the same order to the equation of cointegration. Augmented Dickey Fuller (ADF) test has been carried out in this research paper in order to check the intensity of the unit root test. Johansen cointegration test was run after all the non-stationary variables were regressed to be made into stationary so that the linear combination of the stationary variables can be found. Once all the combinations of cointegration was established, Granger Causality test has been applied to find out the potential causality between all the variables. It is very important to test the time series data for stationary as the non-stationary data in the time series can lead to spurious regression unless at least one cointegrating relationship is present in the analysis. It is crucial to mention that unit root tests tend to possess a non-standard and non-normal asymptotic distribution which in turn highly influences the time trend (Amin 2011).

After the unit root test has been conducted, the optimum time lag length for the unit root test is automatically chosen by the software used—EViews 5.0, based on the Schwartz Information Criterion (SIC). To test for cointegration, Johansen procedure is then applied. This method prepares a unified framework to estimate and test the relationship of cointegration in the context of Vector Autoregressive (VAR) error correction models. For this purpose, an Unrestricted Vector of Autocorrelation of the following form has been estimated:

$$\Delta x_t = \alpha + \theta_1 \Delta x_{t-1} + \theta_2 \Delta x_{t-2} + \theta_3 \Delta x_{t-3} + \cdots\cdots + \theta_{k-1} \Delta x_{t-k+1} + \theta_k \Delta x_{t-k} + u_t$$

Where $\Delta$ is the difference operator, $x_t$ is a $(n \times 1)$ vector of non-stationary variables (in levels); $u_t$ is the $(n \times 1)$ vector of random errors. The matrix $\theta_k$ consists the information on long run relationship between the variables. For instance, if $\theta_k = 0$, the variables are not cointegrated. Moreover, if the rank (usually denoted by $r$) is equal to 1, there exists one cointegrating vector. If $1 < r < n$, then there are multiple cointegrating vectors. There are two tests for cointegration which are derived by Johansen and Juselius (1990) i.e the trace test statistic which estimates the null hypothesis where there is at most r cointegrating vectors. Another one is the maximum Eigen value test which estimates the null hypothesis where there are exactly $r$ cointegrating vectors in $x_t$.

According to the analysis of cointegration, when two variables are cointegrated, there exists atleast one regulation of causality. Granger-causality, introduced by Granger (1969, 1980, 1988), is one of the vital issue that has been widely studied in empirical macroeconomics as well as in empirical finance. The presence of non-stationary variables can lead to misleading and ambiguous conclusions in the Granger Causality tests, as indicated by Engle and Granger (1987). The only possible way to conceive a causal long run relationship between non stationary time series occurs only when the variables are cointegrated. When $y$ and $x$ are regarded as variables of interest, the Granger Causality test (Granger 1969) induces whether the past values of $y$ has added to the current values of $x$, as the past values of $x$

itself provides the information. $y$ is said to "Granger cause" $x$ if and only if $x$ can be predicted using the past values of $x$. If the preceding changes in $y$ do not cause current changes in $x$, then $y$ does not "Granger cause" $x$. Similarly, we can find out whether $x$ Granger causes $y$ by simply interchanging the variables and implementing the same process again. If $x$ causes $y$ but $y$ does not cause $x$, then the causality is said to be unidirectional from $x$ to $y$. There are four possible outcomes:

(i)     $y$ Granger causes $x$ (unidirectional causality from y to x)
(ii)    $x$ Granger causes $y$ (unidirectional causality from x to y)
(iii)   Both $x$ and $y$ Granger cause each other, or
(iv)   Neither of the variables Granger cause the other variables (statistically independent)

In this research paper, the causality test will be conducted among the possible variables, for which two sets of equation are estimated:

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \cdots\cdots + \alpha_l x_{t-l} + \beta_1 y_{t-1} + \cdots\cdots + \beta_l y_{t-l} + u_t$$

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \cdots\cdots + \alpha_l y_{t-l} + \beta_1 x_{t-1} + \cdots\cdots + \beta_l x_{t-l} + v_t$$

In the above sets of equation, we consider for all possible pairs of $(x,)$ series in the group. The reported F-statistics are the Wald statistics for the joint hypothesis

$$\beta_1 = \beta_2 = \beta_3 = \cdots\cdots = \beta_l = 0$$

This research paper delves into the long run relationship and the causality direction between all the health indicators and economic openness of Bangladesh. The statistical software Eviews 5.0 have been used to check all of the econometric tests that has been conducted in this research paper. It is worth mentioning that the data which are used in this paper has been collected from World Development Index (WDI) from 1980 till 2014. All of the econometric results have been given on request.

A convenient method of showing the long run as well as short run dynamics model along with the variables is the Vector Error Correction Model (VECM) which is shown by Engle and Granger (1987). The parameter from the causality in the multi-variant framework is estimated by the following VECM equation below:

$$\Delta Y = \alpha + \sum_{i=1}^{m} \beta i \Delta Y_{t-i} + \sum_{j=1}^{n} \gamma j \Delta X_{t-j} + \sum_{k=1}^{0} \delta \Delta M^s + \sum_{l=1}^{p} \zeta \Delta N + \theta Z_{t-1} + \varepsilon_t \qquad \text{(i)}$$

$$\Delta X = a + \sum_{i=1}^{m} b i \Delta Y + \sum_{j=1}^{n} c j \Delta X_{t-j} + \sum_{k=1}^{0} d \Delta M^s + \sum_{l=1}^{p} e \Delta N + f Z_{t-1} + \xi_t \qquad \text{(ii)}$$

Where, z t-1 stands as the error correction that lags residual series of cointegrating vector. The deviation of the series from long run equilibrium relation n is the measurement of the error correction model. For instance, from equation (i), the null hypothesis: X does not Granger cause Y is rejected if the estimated set of coefficients on the lagged values of X is jointly significant. Moreover, where X appears in the cointegrating relationship, the hypothesis of coefficient of lagged error-correction term is supported. The changes in an independent variable may be

depicted as representing the causal impact in the short-term, whereas the error-correction term adds to the adjustment of Y and X towards their corresponding long-run equilibrium. Hence, the VECM representation helps us to comprehend between the short run and long run dynamic relationships. It is imperative to mention that the Chi-square test statistic is used in order to determine the short run causalities between the pairs of variables in the model.

## 5. Results

In order to determine the order of integration for each of the variables in the data series, unit root tests have been conducted. The Augmented Dickey Fuller (ADF) Unit root tests from Table 2 below shows the existence of unit root tests for all the variables which are non-stationary at their levels and stationary at first differenced forms. When ADF test is applied to confirm if the variables are stationary or non-stationary, different lags are taken in order to check the stationary property of the variables. From Table 2 below, the null hypothesis of unit root in levels of variables and first differences cannot be rejected at 90%, 95% and 99% confidence level. It is easy to understand that all of the variables are stationary either at their level or stationary in their first differences.

**Table 2: Augmented Dickey Fuller Unit Root Test for the Variables**

| Panel 1: Levels | | | |
|---|---|---|---|
| | **ADF Statistics (Only Constant)** | **ADF Statistics (Constant & Trend)** | **Decision** |
| **OPENNESS** | 0.160 | -3.072 | Non-Stationary |
| **FR** | -3.981719 | 0.029175 | Stationary considering only constant, but non-stationary considering constant and trend. |
| **IMR** | -6.455529 | -0.507418 | Stationary considering only Constant, but non-stationary considering constant and trend |
| **LIFE** | -4.243472 | -3.940828 | Stationary |
| Panel 2: First Differences | | | |
| | **ADF Statistics (Only Constant)** | **ADF Statistics (Constant & Trend)** | **Decision** |
| **OPENNESS** | -3.381 | -4.314 | Stationary |
| FR | - | -6.274294 | Stationary |
| IMR | - | -3.354199 | Stationary |
| LIFE | - | - | - |
| ADF test is used to check whether our hypothesis is stationary or non-stationary. The hypothesis can be rejected if the t-statistic is less than critical value at 10% level of significance. | | | |

As the results from Table 2 imply that the variables are stationary, the next stage can be proceeded in order to test for cointegration. Following the application of ADF tests, Johansen cointegration test has been applied in order to check if a long run relationship between economic openness and health exists or not. The details of the findings of the Johansen cointegration test are shown in Table 3 below.

**Table 3: Johansen Cointegration Test**

|  |  | Eigen Value | Statistics | 0.05 Critical Value | **Conclusions** |
|---|---|---|---|---|---|
| Trace | None | 0.978174 | 180.0241 | 47.85613 | 2 Cointegrating equations |
|  | At most 1 | 0.637972 | 53.81091 | 29.79707 |  |
|  | At most 2 | 0.396645 | 20.28178 | 15.49471 |  |
|  | At most 3 | 0.103583 | 3.608527 | 3.841466 |  |
| Maximum Eigen Value | None | 0.978174 | 126.2132 | 27.58434 | 2 Cointegrating equations |
|  | At most 1 | 0.637972 | 33.52913 | 21.13162 |  |
|  | At most 2 | 0.396645 | 16.67325 | 14.26460 |  |
|  | At most 3 | 0.103583 | 3.608527 | 3.841466 |  |

The Johansen approach is used above in order to test if any long-run cointegrating relationship exists between economic openness and health by using the variables Infant Mortality Rate, Fertility Rate, Life Expectancy and Economic Openness which has been integrated in the same order. The results from Table 3 reveal that there are two cointegrating long-run relationship among the variables for both trace test and maximum eigenvalue test.

**Table 4: VECM Test Results (Lag = 2) (Short Run Causal Relationship)**

| Null Hypothesis | **Chi-Square Statistic** | **Prob. Value** | **Conclusions** |
|---|---|---|---|
| OPEN does not Granger Cause FR | 0.964336 | 0.6174 | No Causality |
| FR does not Granger Cause OPEN | 1.587198 | 0.4522 |  |
| OPEN does not Granger Cause IMR | 3.925188 | 0.1405 | No Causality |
| IMR does not Granger Cause OPEN | 2.088290 | 0.3520 |  |
| OPEN does not Granger Cause LIFE | 0.105151 | 0.7457 | No Causality |
| LIFE does not Granger Cause OPEN | 1.205618 | 0.5473 |  |

Next, Vector Error Correction Model (VECM) approach has been used in order to check for the short run causal relationship among the variables. According to the

findings, Table 4 shows that no causal relationship exists in the short run between economic openness, fertility rate, infant mortality rate, and life expectancy.

In the last step, we check for long run causal relationship among the variables. For this, Granger Causality test has been applied in order to check and understand the direction of the causality. The results for the Granger Causality test is shown in Table 5.

**Table 5: Granger Causality Test Results (Lag = 2)**
**(Long Run Causal Relationship)**

| Null Hypothesis | F Statistics | Prob. Value | Conclusions |
|---|---|---|---|
| OPEN does not Granger Cause FR | 39.0304 | 6.E-07 | Bidirectional Causality between OPEN to FR |
| FR does not Granger Cause OPEN | 4.44233 | 0.0432 | |
| OPEN does not Granger Cause IMR | 45.6143 | 1.E-07 | Bidirectional Causality between OPEN to IMR |
| IMR does not Granger Cause OPEN | 5.01089 | 0.0325 | |
| OPEN does not Granger Cause LIFE | 20.3532 | 9.E-05 | Bidirectional Causality between OPEN to LIFE |
| LIFE does not Granger Cause OPEN | 5.57604 | 0.0247 | |

According to the Granger Causality test, Bidirectional Causality runs from Economic Openness to Fertility Rate, Economic Openness to Infant Mortality Rate, and Economic Openness to Life Expectancy. This means that both way causality has been found between FR, IMR and economic openness in the long run.

## 6. Conclusion

This paper has focused on the relationship between economic openness and health status of Bangladesh, and has revealed that economic openness is both a cause and a consequence of increase in health status. A growing number of literatures have examined the relationship between globalization and its effects on health. However, to the best of our knowledge, there is no literature which focuses on the relationship between economic openness and health status from the perspective of Bangladesh. The aim of this paper has been to investigate the long-run as well as short-run causal relationship between economic openness and health status of Bangladesh from the period 1980 to 2014. The Augmented Dickey Fuller (ADF) test has been carried out to check if the variables are stationary or non-stationary. In order to examine a stable relationship, Johansen cointegration test has been applied and it has been found that two coingerating relationship exists between the variables. Furthermore, Granger Causality test has been applied to test for long-run causal relationship among the variables. The results reveal that bidirectional causality exists between economic openness and all the health indicators.

From the findings that have been obtained, it can be established that in the long run, economic openness due to lower trade barriers and global economic integration makes it possible for Bangladesh to achieve higher levels of improvements in health.

As economic openness lowers barriers to trade, it allows to reap the benefits from increased access of medical resources such as prescription drugs, vaccines and other healthcare technologies. Moreover, globalization leads to an increase in per capita income due to higher levels of employment, which in turn increases living standards as well as education for the general population. As per capita income rises, gains from better healthcare is much easier due to globalization.

Similarly, since globalization and health have a positive significant relationship, the rise in per capita income and the increase in the health status of the general population can lead to a boost in the productivity of the overall population which in turn will lead to an increase in economic openness.

As for policy implications, as globalization provides the integration of world economy, the rise in government revenues need to be properly utilized and invested into the health sector. The government needs to take appropriate institutional measures for the advancement of better healthcare services. Through the practical and effective use of these resources, it is vital for the government to implement strategic decisions in terms of national investment for the development of self-reliance and self-sufficiency in healthcare technology.

The main limitations of this paper is that very few empirical literatures studying the relationship between globalization and health outcomes has been present. If more literatures existed, a deeper understanding on the relationship between economic openness and health from the context of Bangladesh could be further established. Moreover, due to time constraints, many aspects of the topic have not been discussed in this present study. Lastly, the time period of the data is relatively small compared to other time series studies that has been done in different countries. The small time period also causes problems for analyzing long term effects.

Further research could be conducted to examine the causal relationship among globalization and mental health of the general population. This can help to provide a broader perspective on how economic openness can affect the state of well-being for both individual and societal levels in the context of globalization.

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## Appendix

**Table 1: Summary of the Previous Studies Based on Economic Openness and Health Status**

| Authors | Research topic | Variables Used | Data | Methodology | Main Findings |
|---|---|---|---|---|---|
| Herzer (2017) | The long-run relationship between trade and population health | Life expectancy, infant mortality, Trade openness | Panel of 74 countries (1960-2010) over five decades. | Panel unit root test, Granger causality test Augmented-Dickey-Fuller (ADF) type test, cointegration, Error Correction Model (ECM) | Long-run causality exists in both directions as trade increase is both a cause and a consequence of increased life expectancy |
| Novignon and Atakorah (2016) | How health sector benefits from trade openness | life expectancy at birth, infant mortality rate and under-five mortality rate, trade openness | Panel data for 42 Sub-Saharan African (SSA) countries (1995-2013) | Fixed Effect Model, Random Effect model, and the Generalized Method of Moments (GMM) models | A positive relationship exists between trade openness and life expectancy. However negative relationship prevails between trade openness and infant mortality rate as well as under-five mortality rate |
| Panda (2014) | The impact of trade on infant mortality | Infant Mortality, Membership of trade agreement African Growth and Opportunity Act | 30 Sub-Saharan African countries | Linear Probability model with mother fixed effects and country fixed effects | AGOA trade agreement leads to a significant reduction in infant mortality rates. |
| Steven, Urbach and Wills (2013) | The relationship between free trade and health | Infant Mortality Rate, Life expectancy of male and female, real GDP per capita | Panel data for for a range of countries (1950-2009) | Fixed Effects Regression Model | Trade openness leads to improvements in life expectancy and infant mortality rates, especially for low-income countries. |
| Anukriti and Kumler (2012) | The effect of trade liberalization on fertility and child health in India | Fertility, infant mortality, sex ratios at birth, tariff reforms | India (1987-1997) | OLS model with mother fixed-effects | Due to trade liberalization, less educated and less wealthy women have a higher chance of giving birth with a lower rate of infant mortality. Moreover, more educated and wealthier mothers experience higher infant mortality. |

## Table 1: Summary of the Previous Studies Based on Economic Openness and Health Status (continued)

| | | | | | |
|---|---|---|---|---|---|
| Mukherjee and Krieckhaus (2011) | Globalization and human well-being | Infant mortality, child mortality, life expectancy, KOF index of globalization | Panel of 132 countries (1970-2007) over five-year intervals | Fixed Effect Estimations | Globalization is positively related to health. |
| Bergh and Nilsson (2010) | The relationship between globalization and life expectancy | The KOF index of globalization and its dimensions, total, male, and female life expectancy at birth | Panel of 92 countries (1970-2005) at different income levels | Panel corrected standard errors (PCSE) with country and period dummies, Fixed Effect estimations | Globalization increase life expectancy, however it is stronger in countries with stable democracies. |
| Owen and Wu (2007) | The effect of economic openness on health outcomes | Infant mortality, female life expectancy, male life expectancy, Trade as share of GDP, black market premium | Panel of 139 countries (1960-1995) over five-year intervals | Fixed Effect Model | Globalization is strongly related to increased life expectancy and lower infant mortality. However, these benefits are primarily enjoyed by less developed countries. |
| Tsai (2007) | The effect of globalization on human well-being | Quality of life measured by Human Development Index (HDI), KOF index of globalization | Panel of 112 low-, middle- and high-income countries (1980-2000) over three ten-year intervals | GLS random effect estimation model | Globalization is positively related to HDI but the result is stronger in more developed countries. |
| Levine and Rothman (2006) | The impact of trade openness on child health | Infant mortality rate, child mortality, life expectancy, immunization rate, expenditures on public health and urbanization rate, GDP per capita | Panel of 100-130 countries | Gravity Model, Two stage least squared regression (2SLS) | increase in trade openness will result in more than half a year reduction in infant mortality |